EXHIBIT 4

Mesa County
Colorado
Voting Systems

Report #3
Election Database and Data Process Analysis

March 19 2022
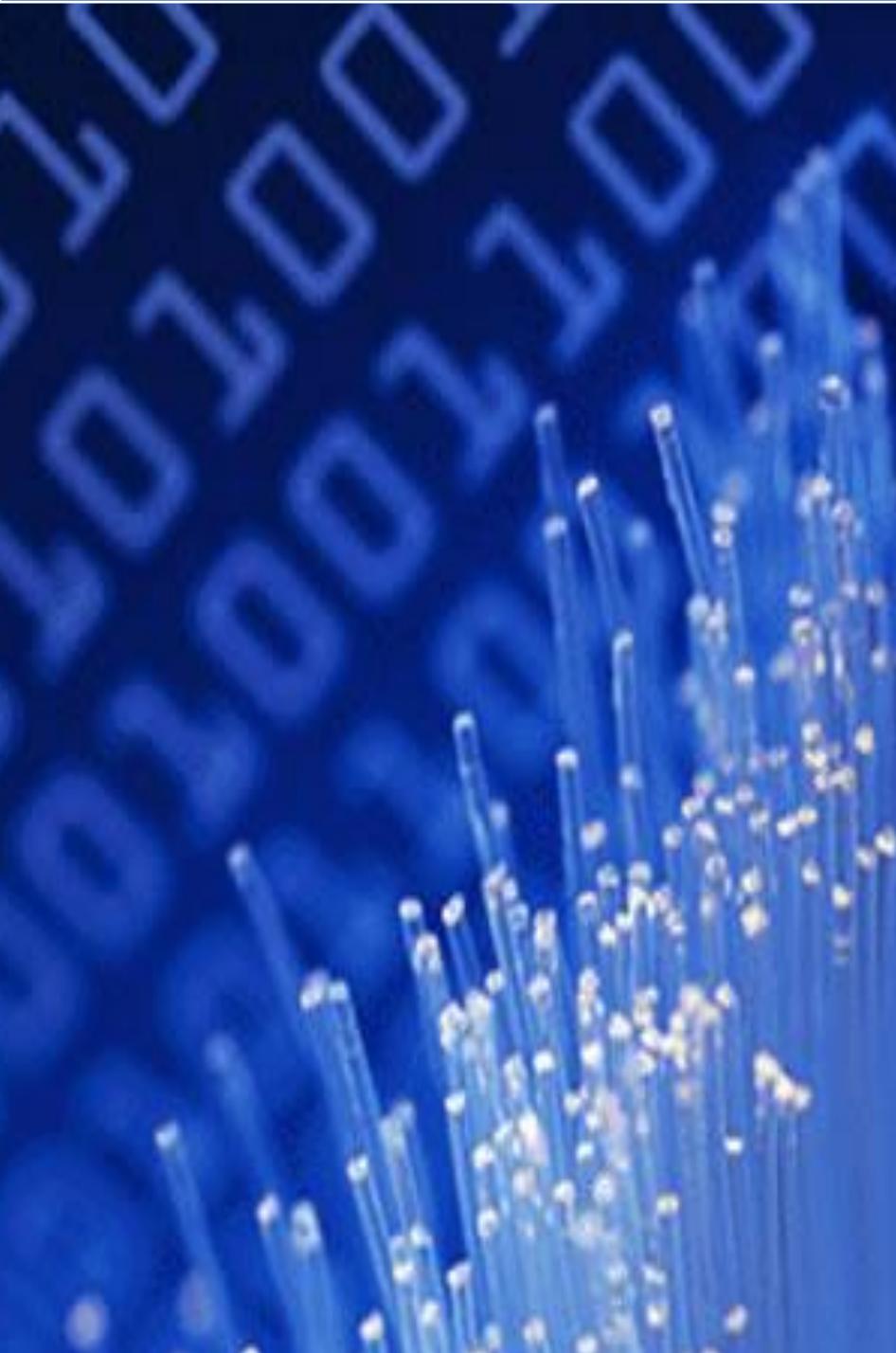
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EXECUTIVE SUMMARY

This report documents the findings of an examination of tabulated vote databases based on forensic analysis of the drive image of Mesa County, Colorado's Dominion Voting Systems (DVS) Election Management System (EMS) server. The findings in this report were prepared by the authors as consultants to the legal team representing Tina Peters, the Mesa County Clerk and Recorder, pursuant to her statutory duties as Mesa County's Chief Election Official. The findings provide evidence of potentially unauthorized and illegal manipulation of tabulated vote data during the 2020 General Election and 2021 Grand Junction Municipal Election. Because of this evidence, which led to the vote totals for those elections being impossible to verify, the results and integrity of Mesa County's 2020 General Election and the 2021 Grand Junction Municipal Election are in question.

This analysis was performed using the forensic image of the EMS server, which was backed up before Colorado Secretary of State and DVS overwrote the hard drive with D-Suite version 5.13.

Findings and Implications:

1) There was an unauthorized creation of new election databases during early voting in the 2020 General Election on October 21, 2020, followed by the digital reloading of 20,346 ballot records into the new election databases, making the original voter intent recorded from the ballots unknown. In addition, 5,567 ballots in 58 batches did not have their digital records copied to the new database, although the votes from the ballots in those batches were recorded in the Main election database.

2) The same unauthorized creation of new election databases occurred during the 2021 Grand Junction Municipal Election on March 30, 2021, followed by the digital reloading of 2,974 ballot records, making the original voter intent recorded on those ballots unknown. In addition, 4,458 ballots in 46 batches did not have their digital records copied to the

new database, although the votes from the ballots in those batches were recorded in the Main election database.

3) The absence of secure hash algorithm (.sha) files for each digital ballot image makes the authenticity of each digital ballot image, and the ballot-level record for those ballots, impossible to verify.

4) The true total vote count in Mesa County, Colorado cannot be accurately calculated for the 2020 General Election or the 2021 Grand Junction Municipal Election from records in the databases of the county's voting system.

5) There is no function or feature on the EMS server that could be executed inadvertently or deliberately by a local election official that would cause this combination of events to occur, especially within the time frame that these events occurred. Given the complex sequence of data manipulations and deletions necessary to produce the digital evidence described in this report, this combination of events could not have been the result of either deliberate or inadvertent actions by those officials.

6) Dominion's installation of the Trusted Build update on the EMS in May of 2021, as ordered by the Colorado Secretary of State, destroyed all data on the EMS hard drive, including the batch and ballot records that evidenced the creation of new databases and reprocessing of ballot records described in Findings 1 and 2 above. This destruction of all data by the trusted build is described in the "Mesa County, Colorado Voting Systems Forensic Examination and Analysis Report".

7) The fact that such ballot record manipulation has been shown demonstrates a critical security failure with the DVS EMS wherever it is used. The manipulation would not be identifiable to an election official using the voting systems, nor to an observer or judge overseeing the election conduct, much less to citizens with no access to the voting systems; without both cyber and database management system expertise, and

unfettered access to database records and computer log files (many of which were destroyed by the actions of the Secretary of State) from the EMS server, the manipulation would be undetectable.

INTRODUCTION

The use of computerized election management systems is now nearly universal across counties in the United States. While the use of these systems is touted as "efficient", potentially decreasing manpower costs and time to produce election results, it also greatly reduces the transparency of the election process and exposes our elections to extraordinary vulnerability from both inadvertent and deliberate misconfiguration or misuse. Americans' right to free and fair elections is inalienable, but that right is infringed by lack of transparency, and by whatever lies behind that opaque curtain.

Without free and fair elections and the transparency to see it for themselves, without relying on the assertions of any other person or organization, Americans' consent and the legitimacy of our government, at all levels, is in doubt. If Americans' votes are to be recorded and counted by machines, every aspect of those machines' operation, configuration, and data must be recorded, immediately available at no cost or administrative burden to citizens and their independent examiners and confirmed 100% accurate through that independent verification. The absence or shortfall of any of those three imperatives (recorded, available, and independently verified) should immediately cause the public to distrust both the purported result from those machines, and also anyone who insists that they accept those results.

Numerous Federal and State laws attempt to safeguard our voting rights and the integrity of our elections. Title 52 USC provides for much of the Federal guidance in this area, and Colorado Revised Statute (CRS) Title 1 covers most of the Colorado state guidance.

a) 52 U.S. Code § 10307 prohibits any person acting under color of law to "…willfully fail or refuse to tabulate, count, and report…" the vote of any person entitled to vote.

b) 52 U.S. Code § 10308(a) prescribes penalties for any person depriving or attempting to deprive any person of voting rights under Federal statute.

c) 52 U.S. Code § 10308(c) prescribes penalties for conspiring to violate or interfere with secured voting rights.

d) 52 U.S. Code § 20701 mandates the preservation of all election records for 22 months after an election for Federal offices.[1,2]

e) 52 U.S. Code § 20702 prescribes penalties for theft, destruction, concealment, mutilation, or alteration of § 20701 election records.

f) 52 U.S. Code § 21081 requires that voting systems used in elections for Federal office meet the standards of that section, including that the voting system shall produce a record with an audit capacity for such system, and that "the error rate of the voting system in counting ballots…shall comply with the error rate standards established under section 3.2.1 of…" the Federal Election Commission 2002 Voting System Standards (VSS).[3]

g) CRS §1-5-601.5 requires that voting systems and equipment in Colorado meet 2002 VSS standards, at minimum.

h) CRS §1-7-802 requires the preservation of election records for 25 months after elections.

i) CRS §1-13-111 prescribes penalties for destroying, removing, or delaying delivery of election records.

Title 52 clarifies that the "every officer of election" is responsible for maintaining the election records.

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[1] U.S. Department of Justice Publication "Federal Law Constraints on Post-Election 'Audits'," July 28, 2021, states that "The materials covered by Section 301 extend beyond 'papers' to include other 'records.' Jurisdictions must therefore also retain and preserve records created in digital or electronic form."

[2] The Federal Election Commission's 2002 Voting System Standards, the standards of which are mandatory minima for certification of voting systems under Colorado state statute § 1-5-601.5., specifies that a voting system which "…provides access to incomplete election returns and interactive inquiries before the completion of the official count…shall: a. …be designed to provide external access to incomplete election returns only if that access for these purposes is authorized by the statutes and regulations of the using agency…b. Use voting system software and its security environment designed such that data accessible to interactive queries resides in an external file, or database, that is created and maintained by the elections software under the restrictions applying to any other output report, namely, that: 1) The output file or database has no provision for write-access back to the system. 2) Persons whose only authorized access is to the file or database are denied write-access, both to the file or database, and to the system," and states that the Standards are "intended to address…risks to the integrity of a voting system...," including "…Changing calculated vote totals;…" and "Preventing access to vote data, including individual votes and vote totals, to unauthorized individuals;…"

[3] 2002 VSS, para 3.2.1 specifies "d. For central-county systems…: Consolidation of vote selection data from multiple counting devices to generate jurisdiction-wide vote counts, including storage and reporting of the consolidated vote data…a target error rate of no more than one in 10,000,000 ballot positions." A ballot position is each and every choice (e.g. a "bubble" which can be marked or filled-in) on a ballot selectable by a voter to convey their voting choices.

Mesa County, Colorado, uses software and hardware provided by DVS and for the 2020 General Election and the 2021 Grand Junction Municipal Election, specifically used "D-Suite 5.11-CO." The primary voting system EMS server, which contains the raw tabulated vote information used to produce official election reports, makes use of Microsoft SQL Server 2016 databases running on the Microsoft Windows Server 2016 operating system. The forensic image used for the analysis, created on May 23, 2021, has been validated as authentic.

DEFINITION OF TERMS

"Ballot": Mesa County used two-sided paper ballots in the November 2020 General Election and the 2021 Grand Junction Municipal Election. A ballot is a device used to cast votes in an election. In Colorado, ballots are pieces of paper defining races and issues, and reflecting the choices of individual voters from among the options available for each race and issue. A digital image of each paper ballot is created by the DVS D-Suite voting system during the processing of ballots, as described below, and that ballot image is stored on the designated "NAS (Network Attached Storage device)" of the D-Suite voting system.

"Adjudication": A term used to describe the process of determining voter intent from a voter's ballot marks, where ballot markings are ambiguous. According to Dominion's Democracy Suite Use Procedure Manual, adjudication is "the process of examining voted ballots to determine, and, in the judicial sense, adjudicate voter intent". In the DVS D-Suite, adjudication refers to the operation and use of a software component called "EMS Adjudication," and the process of using that software component to manually or automatically interpret voter intent from scanned ballot images, and then to record that interpretation as the record of the vote choices for the affected ballots, in both "result files" and ballot images. Depending on software configuration choices, individual ballot images/result files, entire batches of ballot images/result files, or all ballot images/result files can be subjected to automatic or manual adjudication on the basis of "exceptions" or "outstack conditions" (e.g., "overvotes", where too many choices are marked for a race or issue; or "marginal marks" when ballot choice ovals are not adequately filled in), or by the arbitrary decision of EMS administrators.

"Manual Adjudication": Either all ballot images, or individual ballot images, or those from particular batches or tabulators, in which voter intent for any race or issue is flagged by the EMS Adjudication software module as not being determinable (or as having "exceptions"), are, in theory, sent to "Manual Adjudication" stations where officials called "Adjudicators" view the digital images of the ballots and decide the voter's intent. In this Report we sometimes use the terms "manual adjudication" and "machine adjudication" to clearly distinguish the process of human judging of voter intent from the process of the DVS EMS Adjudication software's determining of voter intent.

"Adjudication database": The DVS D-Suite version used in Mesa County during the November 2020 and April 2021 elections maintains a separate SQL Server database, called an "AdjudicableBallotStore," created by DVS software, for each election which contains records of all batches and ballots scanned into the voting system through ImageCast scanning workstations, and any batch and ballot records manually entered. The database maintains critical information about each batch and ballot, most importantly the ballot Adjudication status and the file location of the ballot image. A batch can have any of the following adjudication statuses in the adjudication system: In-Progress, Read Error, Review, Pending Submission, Submitted, or Submission Error.[4] Throughout, "Adjudication database."

"Main election database": The DVS D-Suite version used in Mesa County during the November 2020 and April 2021 elections maintains a database for each election, called an "ElectionStore" by DVS, which contains information defining an election, including contest, candidate, and ballot definitions as well as aggregated vote information which is used to produce all election reports generated by County officials. Throughout, "Main database."

"Tabulation database": The DVS D-Suite version used in Mesa County during the November 2020 and April 2021 elections maintains a database for each election,

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[4] In-Progress batches have been acquired by the system (e.g. through scanning at an ICC) and have ballots being served to clients (Adjudication); Read Error batches are those which encounter errors while being loaded into the system; Review are batches with all ballot adjudication complete, including batches with no adjudication required; Pending Submission are batches submitted to tally, but which have not yet completed that transmission to the tally process; Submitted are batches which have completed the transmission to the tally process; Submission Error are batches that were submitted to the tally process, but which were unsuccessfully submitted.

called a "TabulationStore" by DVS, which contains the timestamps and ballot counts for each batch of ballots, which duplicates that information contained in the Adjudication database. It contains other tables which are not used by Mesa County's elections. Throughout, "Tabulation database."

"Reprocessed": For the purposes of this Report, the term "reprocessed" means that one or more data records which had already been created, presumably by scanning of paper ballots through an ImageCast Central (ICC) workstation, though also technically possible through manual entry of records, within the databases associated with an election, were loaded into the system *again* to a different database, and that this re-loading was not performed in connection within any documented, authorized election-related operations procedure or function. A comparison with the log files of the respective ICC workstations might reveal whether the reprocessed paper ballots were, in fact, rescanned at the ICC, but many of those log files have been destroyed by the Secretary of State's "Trusted Build."

ANALYSIS

I.   Evidence of ballot record data manipulation – November 2020 General Election

Our analysis shows manipulation, which was neither initiated nor authorized by Mesa County election clerks, of the batches and ballots processed during the first three days of ballot processing in the November 2020 General Election.

The following timeline of events, beginning October 19, 2020, when Mesa County began processing ballots in the General Election, demonstrates this manipulation of ballots.

October 19, 2020 – October 21, 2020, 2:14 PM

On these first three days of ballot counting in Mesa County, up until 2:14 PM on October 21, 2020, 267 batches, consisting of 25,913 ballots, were physically processed (physically scanned on DVS ICC scanners with voters' choices, in the

form of marks on the ballots, scanned and interpreted by software) through three tabulators, internally identified in the Main database as tabulator IDs 4, 7, and 10. Mesa County election clerks reported no unusual activity or errors encountered during the processing of these 267 batches. The Adjudication database used at this time contains records of all batches with a sequential "load order" of 1 to 267, and other tables within it record the information about each ballot, for instance the time it was entered into the database, the tabulator used, and the adjudication status. Those which were selected for Adjudication have the proper status records indicating that the normal adjudication steps occurred.

The initial 10 batches processed through tabulator 10, containing a total of 941 ballots, had timestamps indicating that they were all entered into the database within 47 seconds (total – not 47 seconds per batch, but 47 seconds for 10 batches). (See Appendix A for a list of the batches and their timestamps in the **original** Adjudication database.) The Canon DR-G1130, which according to purchasing documents and Colorado Secretary of State voting equipment inventories is the model of scanners used by Mesa County (see Reference C and the Colorado Secretary of State website[5]), operates at approximately 100 pages per minute (ppm), duplex, meaning that scanning both sides of each ballot would take no less than 0.01 minutes, which is 0.6 seconds, per ballot. 941 ballots at 0.6 seconds per ballot should have taken a minimum of 564 seconds, or slightly under 9 and a half minutes, a significantly longer interval than 47 seconds, which is physically impossible. Mesa County election clerks were unaware of these batch timestamps, or any issue which could explain them.

October 21, 2020 - 2:14 PM

According to the data contained in the EMS SQL Server Database, new Tabulation and Adjudication databases were created on the EMS server at 12:18:50 PM October 01, 2020. These databases initially contained no data records.

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[5] CO SecState Voting Equipment Inventory at: https://archive.ph/RQS91

Figure 1. "Before" Screenshot of Databases on the Mesa EMS Server

	name
1	2020 Mesa County General-2020-09-05-00-10-20
2	AdjudicableBallotStore_2020_Mesa_County_General_2020-10-01_12:18:50
3	TabulationStore_2020_Mesa_County_General_2020-10-01_12:18:50

One Adjudication database and one Tabulation database were listed, with creation times before the counting in Mesa County began on October 19, 2020.

Figure 2. "After" Screenshot of Databases on Mesa EMS Server

	name
1	2020 Mesa County General-2020-09-05-00-10-20
2	AdjudicableBallotStore_2020_Mesa_County_General_2020-10-21_14:18:51
3	TabulationStore_2020_Mesa_County_General_2020-10-21_14:18:51
4	AdjudicableBallotStore_2020_Mesa_County_General_2020-10-01_12:18:50
5	TabulationStore_2020_Mesa_County_General_2020-10-01_12:18:50

Two Adjudication databases ("AdjudicableBallotStore") and two Tabulation databases ("TabulationStore") are now listed, one set of which had creation times before the date and time ballot scanning and tabulation began in Mesa County on October 19, 2020 and the other set of which the EMS server data indicate were created two and a half days *after* ballot scanning and tabulation began.

It has been observed that a clerk giving the EMS system a command to stop and then restart adjudication in an election again creates new Adjudication and Tabulation databases. Mesa County clerks are very certain that they did not initiate any such action in either the November 2020 or the April 2021 elections. Therefore, it is likely that a procedure internal to the DVS software had to perform a stop and restart of the adjudication services in order to perform the batch and ballot manipulation which occurred later (see below).

There are only a few possibilities which would explain how the database copying process was initiated.

1. **Direct action by Mesa County personnel**
   The client application used by election clerks does give them the ability to stop and restart adjudication, which would create the new databases.

   However, Mesa County personnel are very clear that they did nothing of the sort and explained that they would only do such a thing in an extreme emergency, as the process would have made the production of legally mandated reports very difficult.

2. **Triggered remotely**
   "Report #2, Forensic Examination and Analysis Report" by D. Gould identifies numerous security vulnerabilities in the DVS EMS server. A signal, or external trigger,[6] giving instructions to software inside the EMS server could have been sent to and received through any of the open communication ports, or through the port 80 Web Server port, which has been demonstrated to be open on the server and accepting commands via an application programming interface (API).[7] This signal, along with other information, could have been received via a local network connection (from any device connected to the EMS server's internal network), from a remote network connection (if the EMS server's internal network has been bridged to the external internet), or via an internal cellular modem installed in the EMS server. If the EMS Server was connected to a wireless network, it is feasible that even a cell phone outside of the building, but still within the wireless signal radius, could have been used to trigger the events.

   This option is plausible but infers a degree of external, time-sensitive control over the DVS equipment in use in Mesa County. This control might

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[6] E.g., an "external trigger" most people are familiar with is the function whereby their smartphone's wi-fi connection is turned on in response to detecting the proximity of a saved, pre-approved wi-fi network. The external trigger satisfies the criteria of an internal, saved rule for application behavior, and the application then executes the correlated command or function. We likely don't think of "Do Not Disturb" mode on our smartphones as being similarly controlled by an external trigger, but if our smartphones are configured to "use network time," meaning the time signal transmitted by the cellular carrier network, then our smartphones' "Do Not Disturb" mode isn't turned on at the time we set, per se, but when our cellular carrier tells our phone that the specified time is reached.

[7] An API is a specification for interaction which allows computer applications to communicate with, make requests to, and issue commands to other computer applications. I.e., API enables machine-machine communication, coordination, and command and control, depending on the permissions and allowable exchanges of the specific API specification.

be considered undesirable by the perpetrators responsible for manipulating the election data, because it was a possibility that any unauthorized network connections, whether they be via standard ethernet, wireless network connection, or cellular modem, could have been discovered during the election period.

3. Algorithmically Triggered

A software algorithm[8] running inside the DVS computer systems in Mesa County could have made the decision to perform the new database creations and the selected record manipulation which followed based on preprogrammed criteria related to the election results at the time.

Given that this method requires the least amount of external control and monitoring, this option would seem to be the most likely. The decision to copy the Adjudication and Tabulation databases and re-process the ballot records would be made by software running inside the Dominion EMS (or inside another connected machine running Dominion software) based on unexpected voting patterns.

October 21, 2020, 2:30 PM – 2:34 PM

During this time period, 209 out of the original 267 batches (containing a total of 20,346 ballots) were digitally – not physically – loaded into the new Adjudication and Tabulation databases. Specifically, records for batches with load order 2 through 59 were not reloaded and do not appear in the new Adjudication database in any form. The timestamps of the 209 batch records (load order 1 and load orders 60 through 267) show an impossibly short processing time (approximately 4 seconds each) for these batches to have been physically processed into the newly created Adjudication and Tabulation databases. As described above, because of the minimum scanning time of one

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[8] An "algorithm" is simply a set of rules for logical, sequential consideration of inputs (e.g. a contingent variable state, like "the switch is off" or "the switch is on," or the value of field/memory location "X" is "1" or is "Not 1") to produce a consistent, expected output. In this case, a simple, hypothetical algorithm might have been something like "IF ('numberofbatches'>50) AND ("ElectionProjectActive"=TRUE) AND ("EMSAdminUserLoggedIn"=FALSE) AND (VOTETOTAL,"InternalMachineID:01">VOTETOTAL,"InternalMachineID:02") AND (SYSTIME>20201019) AND (SYSTIME<20201103) THEN COPY:BATCHID030010:BATCHID030059 AND INSERTINTO "adjudicableballotstore," etc.

minute per batch for the Canon DR-G1130 scanner-based tabulator, it is not possible for these 20,346 ballots to have been physically rescanned (i.e., the paper ballots were not reloaded into the scanning hardware), but rather the digital batch and ballot records were directly added to the new Adjudication database. This indicates that the batches could only have been loaded into the newly created Adjudication and Tabulation databases by using software code or a script running within the EMS server. See Appendix B for a list of all batches and their timestamps in the new Adjudication database. See Appendix C for a list of all commands executed prior to and after the database copy, which provides a precise timeline of the effects of those commands on the database copy.

It is important to note that this unauthorized procedure only copied the records of selected batches of ballots, indicating that this was an intentional act.

Below is a screenshot of the beginning of the list of batches recorded in the original Adjudication database, sorted by the order that they were loaded:

Figure 3. List of Batches Recorded in the Original Adjudication Database, Sorted by Load Order

	TabulatorId	BatchId	Category	CvrBatchId	Name	LoadOrder	CreationTime	ModificationTime
1	10	4001	0	1	Tabulator 10 - Batch 4001	1	2020-10-19 12:07:40.850	2020-10-19 12:09:58.200
2	10	4002	0	2	Tabulator 10 - Batch 4002	2	2020-10-19 12:07:44.443	2020-10-20 10:43:25.547
3	10	4003	0	3	Tabulator 10 - Batch 4003	3	2020-10-19 12:07:48.257	2020-10-20 10:43:26.437
4	10	4004	0	4	Tabulator 10 - Batch 4004	4	2020-10-19 12:07:50.960	2020-10-20 10:43:27.423
5	10	4005	0	5	Tabulator 10 - Batch 4005	5	2020-10-19 12:07:53.960	2020-10-20 10:43:28.500
6	10	4006	0	6	Tabulator 10 - Batch 4006	6	2020-10-19 12:08:12.123	2020-10-20 10:43:29.907
7	10	4007	0	7	Tabulator 10 - Batch 4007	7	2020-10-19 12:08:16.137	2020-10-20 10:43:30.953
8	10	4008	0	8	Tabulator 10 - Batch 4008	8	2020-10-19 12:08:20.107	2020-10-20 10:43:32.390
9	10	4009	0	9	Tabulator 10 - Batch 4009	9	2020-10-19 12:08:24.170	2020-10-20 10:43:33.673
10	10	4010	0	10	Tabulator 10 - Batch 4010	10	2020-10-19 12:08:28.233	2020-10-20 10:43:34.703
11	4	2001	0	11	Tabulator 4 - Batch 2001	11	2020-10-19 12:23:35.457	2020-10-20 10:42:50.047
12	4	2002	0	12	Tabulator 4 - Batch 2002	12	2020-10-19 12:30:25.763	2020-10-20 10:42:51.343
13	4	2003	0	13	Tabulator 4 - Batch 2003	13	2020-10-19 12:32:30.137	2020-10-20 10:42:52.470
14	4	2004	0	14	Tabulator 4 - Batch 2004	14	2020-10-19 12:36:19.937	2020-10-20 10:42:52.970
15	4	2005	0	15	Tabulator 4 - Batch 2005	15	2020-10-19 12:43:25.387	2020-10-20 10:42:53.797
16	4	2006	0	16	Tabulator 4 - Batch 2006	16	2020-10-19 13:50:28.623	2020-10-20 10:42:48.593
17	4	2007	0	17	Tabulator 4 - Batch 2007	17	2020-10-19 13:54:18.990	2020-10-20 10:42:54.533
18	4	2008	0	18	Tabulator 4 - Batch 2008	18	2020-10-19 13:58:23.777	2020-10-20 10:42:56.080
19	4	2009	0	19	Tabulator 4 - Batch 2009	19	2020-10-19 14:03:28.847	2020-10-20 10:42:57.673
20	4	2010	0	20	Tabulator 4 - Batch 2010	20	2020-10-19 14:06:33.427	2020-10-20 10:42:58.877
21	4	2011	0	21	Tabulator 4 - Batch 2011	21	2020-10-19 14:10:23.157	2020-10-20 10:42:59.563
22	4	2012	0	22	Tabulator 4 - Batch 2012	22	2020-10-19 14:14:28.253	2020-10-20 10:43:00.360
23	4	2013	0	23	Tabulator 4 - Batch 2013	23	2020-10-19 14:18:33.053	2020-10-20 10:43:00.970
24	4	2014	0	24	Tabulator 4 - Batch 2014	24	2020-10-19 14:22:22.753	2020-10-20 10:43:01.533

Note that there is a sequential order with all load order numbers represented.

Below is a screenshot of the same table in the newly created Adjudication database:

Figure 4. List of Batches in Newly Created Adjudication database

	TabulatorId	BatchId	Category	CvrBatchId	Name	LoadOrder	CreationTime	ModificationTime
1	10	4001	0	1	Tabulator 10 - Batch 4001	1	2020-10-21 14:20:07.257	2020-10-22 10:33:50.593
2	10	4025	0	60	Tabulator 10 - Batch 4025	60	2020-10-21 14:20:26.273	2020-10-22 10:33:51.907
3	4	2036	0	61	Tabulator 4 - Batch 2036	61	2020-10-21 14:20:30.477	2020-10-22 10:31:56.047
4	10	4026	0	62	Tabulator 10 - Batch 4026	62	2020-10-21 14:20:34.430	2020-10-22 10:33:53.330
5	4	2037	0	63	Tabulator 4 - Batch 2037	63	2020-10-21 14:20:39.043	2020-10-22 10:31:56.780
6	10	4027	0	64	Tabulator 10 - Batch 4027	64	2020-10-21 14:20:43.107	2020-10-22 10:33:54.423
7	10	4028	0	65	Tabulator 10 - Batch 4028	65	2020-10-21 14:20:47.370	2020-10-22 10:33:55.703
8	4	2038	0	66	Tabulator 4 - Batch 2038	66	2020-10-21 14:20:51.527	2020-10-22 10:31:57.297
9	4	2039	0	67	Tabulator 4 - Batch 2039	67	2020-10-21 14:20:55.887	2020-10-22 10:31:58.187
10	4	2040	0	68	Tabulator 4 - Batch 2040	68	2020-10-21 14:21:00.060	2020-10-22 10:31:58.860
11	4	2041	0	69	Tabulator 4 - Batch 2041	69	2020-10-21 14:21:04.060	2020-10-22 10:31:59.907
12	10	4029	0	70	Tabulator 10 - Batch 4029	70	2020-10-21 14:21:08.260	2020-10-22 10:33:56.843
13	4	2042	0	71	Tabulator 4 - Batch 2042	71	2020-10-21 14:21:12.747	2020-10-22 10:32:00.593
14	10	4030	0	72	Tabulator 10 - Batch 4030	72	2020-10-21 14:21:16.810	2020-10-22 10:33:57.640
15	4	2043	0	73	Tabulator 4 - Batch 2043	73	2020-10-21 14:21:20.747	2020-10-22 10:32:01.217

While the record of the batch with load order 1 was copied, there is a gap of 58 batches before the second line, which is a record of the batch with load order 60. Batch load order numbers 2 through 59 were *not* copied, effectively deleting them in the new Adjudication database.

The data records describing the batches and the ballots contained within them in the new Adjudication database, specifically the time stamps shown in Appendix B as well as statements by Mesa County election officials, indicate that the paper ballots and batches were not physically re-scanned. Therefore, it appears the process of scanning these ballots was simulated, and the records of the batches and the ballots contained within them were electronically transferred from the original Adjudication database into the new Adjudication database.

For example, below is the sequence of events detailing the processing of batch 4024 (whose ballots and records were *not* copied to the new Adjudication database) and batch 4025 (whose ballots and records were copied to the new Adjudication database). This will illustrate the contrast between copied and uncopied batch and ballot records.

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Batch 4024 is recorded in the original Adjudication database as being created at 4:09:34 PM on October 19. It contained 100 ballots and was scanned by tabulator 10. Ten of these ballots from batch 4024 were subsequently manually adjudicated. The manually adjudicated ballot numbers in the batch which were manually adjudicated were 4, 8, 13, 14, 30, 48, 63, 87, 88, and 90. Then, the votes contained on all 100 ballots were recorded in the appropriate tables in the Main database (see Reference A for a list of these tables). When the new Adjudication database was created, no records from Batch 4024 were copied to it, and thus there was no reprocessing or physical rescanning of the ballots. Adjudication history for the 10 ballots which were manually adjudicated was no longer available to the Mesa County clerks, and the original voter intent of these ballots is unknown.

In contrast, Batch 4025 is recorded in the original Adjudication database as being processed at 4:12:23 PM on October 19. This batch contained 99 ballots and was also scanned by tabulator 10. Fourteen of these ballots were subsequently manually adjudicated. The ballot numbers in the batch which were manually adjudicated were 3, 10, 13, 21, 22, 23, 34, 40, 49, 59, 66, 79, 97, and 99. Then, the votes contained on all 99 ballots were recorded in the appropriate tables in the Main database.

After the new Adjudication database was created, a record of Batch 4025 appeared in its tables at 2:20:26 PM on October 21. It is still listed as having 99 ballots and from tabulator 10. In the new Adjudication database, however, only 6 of the batch 4025 ballots (8 less than the first time these batches were entered into the original Adjudication database), were *again* manually adjudicated. The individual ballot numbers were 3, 21, 22, 40, 59, and 66. At this point, the vote records from at least those 6 ballots and possibly all 99 would have been recorded in the appropriate tables in the Main database, replacing the votes which were already in that database from those ballots. Adjudication history for the 14 ballots which were manually adjudicated was no longer available to the Mesa County clerks, and the original voter intent of these ballots is unknown.

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The selected batches in the new Adjudication database (batch 1 and batches 60 through 267) appeared in the same serial order that they were loaded into the original Adjudication database, with the same batch numbers, ballot counts, and load order numbers (compare Appendix A and Appendix B).

October 21, 2020, shortly after 2:34 PM

At this point, as reported by Mesa County election officials, some Mesa County adjudication officials began noticing that they were being asked to look at ballots that they had already adjudicated. This is consistent with these ballots and batches being reprocessed in the new Adjudication database. When the new Adjudication database was created, and the selected records described above were copied and reprocessed, there were outstanding ballots from the last set of batches scanned before the event. As some of these ballots were sent to manual adjudication again after the batches were reprocessed, this caused a situation where the same ballot was in the manual adjudication process twice. This caused confusion among the election staff who were assigned the duty of manual adjudication, since when a ballot was adjudicated the second time the master count of adjudicated ballots, which is displayed by the Dominion system and is used by the election clerks to track the overall adjudication process, did not change. This caused the Adjudication officials to assume that there had been an error and, in some cases, to attempt additional manual adjudications of the same ballot with the same unsatisfactory result.

According to several Mesa County election officials, DVS support was contacted at approximately 4PM on the 21st of October, and while the support representative claimed to not have a solution for the issue Mesa County was seeing, that issue ceased soon afterwards. This indicates that DVS may have performed or caused to be performed an operation unknown to Mesa County election officials (and outside of their control) to address this problem which manifested after the unauthorized database manipulation.

Of the 209 batches which were processed twice (batches 1 and 60 through 267), the ballot counts match between the old and new Adjudication database. However, DVS software marked 2,166 ballots for manual adjudication the first time they were processed in the original Adjudication database, but when reprocessed in the new Adjudication database the software marked only 965 ballots for manual adjudication.

The same ballots run through the same hardware and evaluated by the same software should have had the same resulting ballots marked for adjudication, but they did not. This leads to the logical critical conclusion that not all the ballots in the batches processed after the database copy were the same and had the same votes as the ballots in the same batches processed before the database copy. There is no record remaining of the votes originally recorded from the ballots, and therefore there can be no certainty that the votes now recorded are the same. In essence, the chain of custody has been broken for these votes in the database.

The 58 batches which were *not* duplicated in the new Adjudication database must also be seen as suspect, as their chain of custody has also been broken via the fact that no record of them or their adjudication exists in the Adjudication database in use at the end of the election. A clerk wishing to view the adjudication status of a ballot in any of the 58 batches would be unable to do so, as no information about those batches exists in the new Adjudication database.

Thus, all 25,931 ballot records processed before 2:14 PM on October 21, 2020, comprising over 25% of the County's total over the entire election, cannot be verified and should not have been counted.

II.   Evidence of Ballot Manipulation – April 2021 Grand Junction Municipal Election

Our analysis shows a nearly identical manipulation of the batches and ballots processed during the first six days of ballot processing in the April 2021 Municipal Election in Grand Junction, Colorado.

The timeline of events beginning March 24, 2021, when Mesa County Election clerks began processing ballots in the 2021 Grand Junction Municipal Election, follows.

March 24, 2021 – March 30, 2021, 2:43 PM

On these first seven days of counting, up until 2:43 PM on March 30, 2021, 88 batches of ballots, consisting of 8,540 ballots, were processed. County Election clerks report no unusual activity or errors encountered *at any time* during the election counting process. The Adjudication database used at this time contains records of all batches with a sequential load order of 1 to 88, and other tables within it record each ballot. Those which were selected for Manual Adjudication (339 in total) have the proper status records indicating the normal adjudication steps occurred.

March 30, 2021, 2:58 PM

According to the data contained in the EMS server, new Adjudication and Tabulation databases were created and registered within the DVS system as the associated databases for the election. As in the circumstance previously described in the early voting period for the November 2020 election, these two databases initially contained no data.

See Appendix D for a list of all commands executed prior to and after the database creation in the April 2021 Municipal Election, which provides a precise timeline of the effects of creating the new databases and copying the batch and ballot records.

It is important to note that this unauthorized procedure copied the records of only selected batches of ballots, indicating that this was an intentional act.

Below is a screenshot of the beginning of the list of batches recorded in the original Adjudication database, sorted by the order that they were loaded:

Figure 5. List of Batches Recorded in the Original Adjudication Database, Sorted by Load Order

TabulatorId	BatchId	Category	CvrBatchId	Name	LoadOrder	CreationTime	ModificationTime
30	3000	0	2	Tabulator 30 - Batch 3000	1	2021-03-24 14:52:58.350	2021-03-29 14:07:57.213
30	3001	0	3	Tabulator 30 - Batch 3001	2	2021-03-24 15:09:05.203	2021-03-29 14:07:57.557
30	3002	0	4	Tabulator 30 - Batch 3002	3	2021-03-24 15:10:53.607	2021-03-29 14:07:57.917
30	3003	0	5	Tabulator 30 - Batch 3003	4	2021-03-24 15:13:57.637	2021-03-29 14:07:58.307
30	3004	0	6	Tabulator 30 - Batch 3004	5	2021-03-24 15:17:01.500	2021-03-29 14:07:58.587
30	3005	0	7	Tabulator 30 - Batch 3005	6	2021-03-24 15:21:03.903	2021-03-29 14:07:58.837
30	3006	0	8	Tabulator 30 - Batch 3006	7	2021-03-24 15:24:05.780	2021-03-29 14:07:56.837
30	3007	0	9	Tabulator 30 - Batch 3007	8	2021-03-24 15:28:55.220	2021-03-29 14:07:59.273
30	3008	0	10	Tabulator 30 - Batch 3008	9	2021-03-24 15:33:59.600	2021-03-29 14:07:59.650
30	3009	0	11	Tabulator 30 - Batch 3009	10	2021-03-24 15:37:03.750	2021-03-29 14:08:00.010
30	3010	0	12	Tabulator 30 - Batch 3010	11	2021-03-29 11:06:24.310	2021-03-29 14:08:00.323
30	3011	0	13	Tabulator 30 - Batch 3011	12	2021-03-29 11:38:04.150	2021-03-29 14:08:00.667
30	3012	0	14	Tabulator 30 - Batch 3012	13	2021-03-29 11:42:52.697	2021-03-29 14:08:01.040
30	3013	0	15	Tabulator 30 - Batch 3013	14	2021-03-29 11:45:56.630	2021-03-29 14:08:01.383
30	3014	0	16	Tabulator 30 - Batch 3014	15	2021-03-29 11:48:00.360	2021-03-29 14:08:01.713
30	3015	0	17	Tabulator 30 - Batch 3015	16	2021-03-29 11:51:03.987	2021-03-29 14:08:02.040
30	3016	0	18	Tabulator 30 - Batch 3016	17	2021-03-29 13:05:52.907	2021-03-29 14:08:02.400
30	3017	0	19	Tabulator 30 - Batch 3017	18	2021-03-29 13:08:56.587	2021-03-29 14:08:02.743
30	3018	0	20	Tabulator 30 - Batch 3018	19	2021-03-29 13:12:00.483	2021-03-29 14:08:03.073
30	3019	0	21	Tabulator 30 - Batch 3019	20	2021-03-29 13:14:04.207	2021-03-29 14:08:03.400
30	3020	0	22	Tabulator 30 - Batch 3020	21	2021-03-29 13:19:53.690	2021-03-29 14:08:03.727
30	3021	0	23	Tabulator 30 - Batch 3021	22	2021-03-29 13:22:57.557	2021-03-29 14:08:04.103
30	3022	0	24	Tabulator 30 - Batch 3022	23	2021-03-29 13:26:01.097	2021-03-29 14:08:04.430
30	3023	0	25	Tabulator 30 - Batch 3023	24	2021-03-29 13:28:04.527	2021-03-29 14:08:04.790
30	3024	0	26	Tabulator 30 - Batch 3024	25	2021-03-29 13:30:53.410	2021-03-29 14:08:05.133
30	3025	0	27	Tabulator 30 - Batch 3025	26	2021-03-29 13:32:57.050	2021-03-29 14:08:05.540
30	3026	0	28	Tabulator 30 - Batch 3026	27	2021-03-29 13:37:01.250	2021-03-29 14:08:05.900
30	3027	0	29	Tabulator 30 - Batch 3027	28	2021-03-29 13:40:05.090	2021-03-29 14:08:06.227
30	3028	0	30	Tabulator 30 - Batch 3028	29	2021-03-29 13:41:53.687	2021-03-29 14:08:06.573
30	3029	0	31	Tabulator 30 - Batch 3029	30	2021-03-29 13:44:57.640	2021-03-29 14:08:06.900

Below is a screenshot of the same table in the newly created Adjudication database, sorted by creation time:

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Figure 6. List of Batches in the Newly Created Adjudication Database, Sorted by Creation Time

TabulatorId	BatchId	Category	CvrBatchId	Name	LoadOrder	CreationTime	ModificationTime
30	3047	0	49	Tabulator 30 - Batch 3047	48	2021-03-30 15:00:14.560	2021-03-30 15:25:33.373
30	3048	0	50	Tabulator 30 - Batch 3048	49	2021-03-30 15:00:17.950	2021-03-30 15:25:34.090
30	3050	0	52	Tabulator 30 - Batch 3050	51	2021-03-30 15:00:36.577	2021-03-30 15:25:33.733
30	3054	0	56	Tabulator 30 - Batch 3054	55	2021-03-30 15:00:50.780	2021-03-30 15:03:21.940
20	2000	0	59	Tabulator 20 - Batch 2000	58	2021-03-30 15:01:01.250	2021-03-30 15:03:19.520
20	2002	0	61	Tabulator 20 - Batch 2002	60	2021-03-30 15:01:07.983	2021-03-30 15:03:19.847
20	2003	0	62	Tabulator 20 - Batch 2003	61	2021-03-30 15:01:11.467	2021-03-30 15:03:20.050
20	2004	0	63	Tabulator 20 - Batch 2004	62	2021-03-30 15:01:15.123	2021-03-30 15:03:19.127
20	2005	0	64	Tabulator 20 - Batch 2005	63	2021-03-30 15:01:18.687	2021-03-30 15:03:20.237
20	2006	0	65	Tabulator 20 - Batch 2006	64	2021-03-30 15:01:22.203	2021-03-30 15:03:20.410
20	2008	0	67	Tabulator 20 - Batch 2008	66	2021-03-30 15:01:29.203	2021-03-30 15:03:20.627
20	2009	0	68	Tabulator 20 - Batch 2009	67	2021-03-30 15:01:32.953	2021-03-30 15:03:20.847
20	2010	0	69	Tabulator 20 - Batch 2010	68	2021-03-30 15:01:36.467	2021-03-30 15:03:21.033
20	2011	0	70	Tabulator 20 - Batch 2011	69	2021-03-30 15:01:40.437	2021-03-30 15:03:21.237
20	2012	0	71	Tabulator 20 - Batch 2012	70	2021-03-30 15:01:44.513	2021-03-30 15:03:21.410
20	2013	0	72	Tabulator 20 - Batch 2013	71	2021-03-30 15:01:48.063	2021-03-30 15:03:21.567
20	2015	0	74	Tabulator 20 - Batch 2015	73	2021-03-30 15:01:55.170	2021-03-30 15:03:21.723
20	2016	0	75	Tabulator 20 - Batch 2016	74	2021-03-30 15:01:58.827	2021-03-30 15:03:39.753
20	2018	0	77	Tabulator 20 - Batch 2018	76	2021-03-30 15:02:05.920	2021-03-30 15:03:47.913
20	2019	0	78	Tabulator 20 - Batch 2019	77	2021-03-30 15:02:09.407	2021-03-30 15:03:48.210
20	2020	0	79	Tabulator 20 - Batch 2020	78	2021-03-30 15:02:13.140	2021-03-30 15:03:47.613
20	2021	0	80	Tabulator 20 - Batch 2021	79	2021-03-30 15:02:16.017	2021-03-30 15:03:51.317
20	2023	0	82	Tabulator 20 - Batch 2023	81	2021-03-30 15:02:22.517	2021-03-30 15:04:13.667
20	2024	0	83	Tabulator 20 - Batch 2024	82	2021-03-30 15:02:26.050	2021-03-30 15:04:18.870
20	2025	0	84	Tabulator 20 - Batch 2025	83	2021-03-30 15:02:29.580	2021-03-30 15:04:18.527
20	2026	0	85	Tabulator 20 - Batch 2026	84	2021-03-30 15:02:33.597	2021-03-30 15:04:20.793
10	1001	0	87	Tabulator 10 - Batch 1001	86	2021-03-30 15:02:40.610	2021-03-30 15:04:48.777
10	1002	0	88	Tabulator 10 - Batch 1002	87	2021-03-30 15:02:44.050	2021-03-30 15:04:49.120
10	1003	0	89	Tabulator 10 - Batch 1003	88	2021-03-30 15:02:47.423	2021-03-30 15:04:48.417
10	1000	0	96	Tabulator 10 - Batch 1000	114	2021-03-30 16:04:55.357	2021-03-30 16:17:49.813

March 30, 2021, 3:00 PM – 3:03 PM

During this three-minute time period, records of 42 batches and the 4,082 ballots contained within them, previously processed into the original Adjudication database, were copied into the new Adjudication database. According to the time stamps, the records of the batches appeared in the new Adjudication database in intervals of a fraction of a second between them, much too quickly for the ballots contained in the batches to have been physically scanned (per the maximum scanning speeds discussed above). Mesa County election clerks state that they did not take any action to reprocess or re-scan any batches on that day, nor did they at any time stop and restart the Adjudication software process. Only 39 ballots in these 42 batches went through manual adjudication after being copied to the new database, and database records indicate that the adjudication process was completed successfully on those 39 ballots.

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Unlike what was found in the November 2020 General Election records described above, the records for these 42 batches which were copied to the new database do not appear in the new Adjudication database in exactly the same order as they had originally been loaded; 12 batch records are out of order when the records in the original Adjudication database and the new Adjudication database are compared.

No further anomalies are shown in the Adjudication database records during the Election counting process, nor did Mesa County election clerks encounter any unexpected issues.

Of the 42 batches which were processed twice (batches 45 through 49 and 51 through 88), the ballot counts (total number of ballots) match between the old and new Adjudication databases. However, DVS software sent 339 ballots to manual adjudication the first time they were processed in the original Adjudication database, but when reprocessed in the new Adjudication database the software sent just 39 ballots to manual adjudication.

The same ballots run through the same hardware and evaluated by the same software should have had the same resulting ballots marked for adjudication, but they did not. This leads to the logical critical conclusion that not all the ballots in the batches processed after the database copy were the same and had the same votes as the ballots in the same batches processed before the database copy. There is no record remaining of the votes originally recorded from the ballots, and therefore there can be no certainty that the votes now recorded are the same. In essence, the chain of custody has been broken for these votes in the database.

The 46 batches which were *not* duplicated in the new Adjudication database must also be seen as suspect, as their chain of custody has also been broken via the fact that no record of them or their adjudication exists in the Adjudication database in use at the end of the election. A clerk wishing to view the adjudication status of a ballot in any of these 46 batches would be unable to do

so, as no information about these batches exists in the new Adjudication database.

Thus, all 8,540 ballots processed before 2:58 PM on March 30, 2021, comprising over 49% of the total votes in the entire 2021 Grand Junction Municipal Election, cannot be verified and should not have been counted. These 8,540 ballots represent more than twice the winning margin in any of the four City Council races that occurred in this election.

III. Comparison of the November 2020 General Election Findings and the April 2021 Grand Junction Municipal Election Findings

Comparing the above findings for the two elections shows numerous similarities and also critical differences.

Similarities:
- In both elections, a software process running within the DVS system performed an unauthorized creation of new Adjudication and Tabulation databases.
- In both elections, database records of selected batches and of the ballots within those batches were copied into the new databases and were reprocessed.
- In both elections, selected batches were not copied to the new Adjudication and Tabulation databases, making adjudication information invisible to the Mesa County election clerks.

Differences:
- In the November 2020 General Election, records of a sequential series of batches and the ballots contained within them were copied from the original Adjudication and Tabulation databases to the new Adjudication and Tabulation databases, and the batches were copied in the same order as in the original databases. In the April 2021 Grand Junction Municipal Election, records of a non-sequential series of batches and the ballots contained within

them were copied, and they appear in the new Adjudication database in a different order than in the original database.

- In the April 2021 Grand Junction Municipal Election, the EMS User Logs (which show events and commands which were executed) show reference to a batch 89. As there were 88 batches in the original Adjudication database, this would have logically been the next batch received from the scanners. However, no record of a batch with the load order '89' exists in either Adjudication database, and there are missing load orders between 88 and 114 as well.

The similarities lead to the conclusion that the same method was used to alter the database records in both elections.

The differences lead to the conclusion that there is a degree of control in the method used to alter the database records which used parameters unique to each election.

IV.   Summary Impact of Above Findings

This manipulation of batch and ballot records described above is significant for three reasons.

First, when the ballots were reprocessed as described above, including re-adjudication, it is logical to conclude that whatever votes had been initially recorded could well have been replaced by the reprocessed votes in the Main election database. The differences in the Manual Adjudication numbers certainly supports this possible conclusion. Thus, this procedure could change votes in the Main database without leaving any evidence to indicate changes had been made, or any way to determine the nature of the changes or what the original vote data was.

Second, the adjudication status (including the timestamps of adjudication events, the results of the adjudication, and the user who performed the

adjudication) of any ballots in the batches not copied to the new Adjudication database would not be viewable through the DVS client software applications.

Third, an examination of the EMS server which was less rigorous than ours would not likely have caught the fact that the Adjudication and Tabulation databases used at the end of the elections were not the same, nor did they contain the same records, as the databases used at the beginning of the elections. This leads to the possible conclusion that some batches and ballots were excluded from the new databases so as to inhibit the possibility of their being audited or examined.

V.   Lack of Referential Integrity in DVS Database Tables

Most modern database designs include a concept called "referential integrity." For example, if you have one table of data that has information about "people," and another table that has information about "colleges," you might have a field in an individual record in the "people's" table that can contain an id, or pointer, to the college he or she attended. Referential integrity, in this case, would mean that if "John Smith's" record had a pointer to the "University of Pittsburgh", the system should give an error if you try to remove the item "University of Pittsburgh" from the "colleges" table. It would not allow you to do this action because a field in "John Smith's" record refers to the college "University of Pittsburgh" and deleting that entry in the "colleges" table makes "John Smith's" record invalid.

However, some of the DVS Election Management System data structures have no such referential integrity built into them. Therefore, batch records in one database could be deleted without any consequence to records that point to that batch in another database, and without any detection of the error. This lack of referential integrity means that vote or ballot information could easily be added or removed from one part of the database without any warnings or errors occurring in other parts of the database.

It is, for example, possible to change the fields with vote counts in one table of the Main election database without having that change affect any other tables

or cause a referential integrity violation. This is a fundamental and critical breach of sound database design, particularly considering the importance of chain-of-custody and audit trail evidence for the provenance of ballot record and tabulated vote information in a voting system.

Please see Reference D for an example of how the batch and ballot data moves through the various databases and tables in the Dominion EMS.

VI.   Digital Ballot Images are Obfuscated and Unverifiable

An attempt was made to investigate the conditions of the digital ballot images to corroborate the findings above. This avenue of research is greatly hindered because the ballot IDs or sequence numbers in the batches are not relatable to their images, not even within the DVS databases themselves. This is an additional example of a lack of referential integrity within the system.

Additionally, the digital ballot images do not have the accompanying ".sha" files which are meant to prove the authenticity of the ballots. Therefore, any findings, including the integrity and authenticity of ballot images, related to the digital ballot images cannot be absolutely validated because there is no proof that the images are the ones created at the time the ballots were first processed.

Finally, code running within the EMS server that has the system access rights to create and alter SQL Server database records could be used to alter the stored digital ballot images themselves. The EMS Adjudication module software already has the capability of altering scanned images and legitimately does so for each manually adjudicated ballot.

DISCUSSION

The events described above show a significant manipulation of a large number of batch, ballot, and vote records in the DVS EMS Database in Mesa County, and there are only a few possible explanations for the manipulation.

1. Human Error

Extensive questioning of Mesa County election clerks has ruled out human error as the reason for the unauthorized creation of election databases on October 21, 2020, followed by reprocessing of 20,346 ballots. These personnel have a strong recollection of the events of October 21, 2020, and because of the timelines established both by their recollection and corresponding database time stamps, it is evident that any and all unusual actions they might have taken on that day were in response to the new database's creation having already occurred, and batch records being copied into the new database, which affected their ability to complete adjudication on some in-process ballots. Similarly, Mesa County election officials have a strong recollection of the events of March 30, 2021. They state that they did not take any steps that would have given rise to the unauthorized creation of new election databases during the 2021 Grand Junction Municipal Election on that day, followed by the reprocessing of 2,974 ballots,.

2. Software Failure

While an error or failure in the DVS EMS server is a possibility, it strains credulity that any error could cause the numerous specific events which are documented above. In particular, the non-sequential reloading of the batches during the 2021 Grand Junction Municipal Election, when compared with the sequential reloading in the November 2020 General Election, makes it inherently impossible for the same error to have caused both chains of events.

However, as noted in the section above labelled "Algorithmically Triggered", the DVS EMS server (or another connected machine running Dominion software) could have been preprogrammed to perform the unauthorized new database creations and the selected record manipulation which followed based on preprogrammed criteria related to the election results at the time. This would be the result of advance planning in the deliberate

design of the software to alter outcomes when unexpected voting patterns were detected.

3. **Network Breach or Pre-Installation of Manipulating Software or Algorithm**

A device external to the DVS D-Suite network could have connected to the DVS D-Suite and to the EMS server, using the open SQL Server port 1433, open Web Services port 80, or through any other open port directly into the DVS Software. As outlined in "Report #2, Forensic Examination and Analysis Report" by D. Gould, there are numerous flaws in the security of the server, many of which could provide an outside entity with direct access to the SQL Server Database or the Application itself. The DVS D-Suite makes use of "SOAP" messaging protocol API calls through its web server, so malicious procedures could be triggered by simple port 80 access.

As *all* Windows log files which would show these accesses are configured, as specified by DVS manuals published by the Colorado Secretary of State as mandatory technical procedures for County election officials, to keep only a small amount of log entries before they are overwritten, no record of external access to the DVS D-Suite is available in system logs.

Regardless of whether the voting system was connected to an external network or device, even momentarily, or whether a pre-installed software or algorithm was triggered by an external command or complex set of variable conditions, the execution of manipulating software or algorithm could plausibly be responsible for the results described in our findings.

CONCLUSIONS

1. Unauthorized creation of new Tabulation and Adjudication databases occurred during the counting of the November 2020 General Election, along with the selective copying of batch and ballot records from the original databases to the new ones. This manipulation places all 25,913 initial ballots counted into a state where they cannot be validated – some because

it is possible that their vote information was changed, and unverifiable that it was not, and the rest because their "chain of evidence" has been intentionally obfuscated. Even if the count and content of ballot images match the numbers and counts reported by the database, there is no method to validate those ballot images due to missing ".sha" files, which are intended to provide such validation.

2. Unauthorized creation of new Tabulation and Adjudication databases occurred during the 2021 Grand Junction Municipal Election, along with the selective copying of batch and ballot records from the original databases to the new ones. This places all 8,540 initial ballots counted into a state where they cannot be validated – some because it is possible that their vote information was changed and unverifiable that it was not, and some because their "chain of evidence" has been intentionally obfuscated.

3. As we have found evidence that thousands of ballot records have had their validity placed in serious question, none of the election results from the 2020 General or 2021 Grand Junction Municipal Elections in Mesa County can be considered trustworthy. If Mesa County has preserved the respective paper ballots, as they are required to do by law, and those ballots were forensically authenticated with confirmed chain-of-custody from eligible electors to sworn county election officials (not possible retrospectively, nor under current election procedures in Colorado), then a hand-count of paper ballots might support a verifiable, trustworthy conclusion about the county-level results of these two elections.

4. Because the unauthorized methods used to alter batch and ballot-level information described above are available within the DVS EMS server, this system cannot be considered reliable for use in any election. An investigation, involving all physical and cyber evidence, including a source code audit of the exact, verifiable version of all DVS-supplied executable and library files, is necessary to identify the exact software methods used to produce the manipulation and to determine other potential unauthorized actions that the code is able to cause or enable.

5. The Dominion Voting System's database structure stores actual vote information in only one table, in aggregated form, so alterations made to vote counts or candidates in just that table, create a single point of attack or failure for the entire vote reporting process (see Reference D).

REFERENCE A – DATABASES AND TABLES

In order to assist other researchers, who may wish to examine these findings or perform additional analysis, here are the most important databases and tables which were used in this analysis.

Main election databases:

November 2020 General Election:
[2020 Mesa County General-2020-09-05-00-10-20]

April 2021 Municipal Election:
[City of Grand Junction-Municipal Election 2021-2021-02-05-16-01-32]

Primary Tables (specifically related to vote totals):
ResultContainer: (Batch level raw vote data)
ResultSplitter: (Vote Data by Polling Location
ChoiceResult: (Raw aggregated vote data)
CastVoteRecord: (Raw per-ballot list)
Choice: (All Candidates/Choices)
Contest: (All contests in Election)
Tabulator: (All defined tabulators)

Stored Procedures (useful for checking final results):
GetContestResults: Displays current results of any or all contests
GetContestStatistics: Displays stats for any or all contests, including undervotes and overvotes

Adjudication databases:

November 2020 General Election:
[AdjudicableBallotStore_2020_Mesa_County_General_2020-10-01_12:18:50] (before copy)
[AdjudicableBallotStore_2020_Mesa_County_General_2020-10-21_14:18:51] (after copy)

April 2021 Municipal Election:
[AdjudicableBallotStore_City_Of_Grand_Junction_Municipal_Election_2021_2021-03-18_10:48:14] (before copy)

[AdjudicableBallotStore_City_Of_Grand_Junction_Municipal_Election_2021_2021-03-30_14:58:56] (after copy)

Primary Tables:

Batches: Raw batch information

SerializedAdjudicableBallots: Contains one data record for each ballot received.

BallotStatusEvents: Every ballot with Adjudication status. New records for same ballot whenever any change occurs in the status of the ballot.

REFERENCE B – SCANNER SPEED

4.5 Processing Rate

The central scanning device's processing rate also depends on the handling and poll verification activities.

The number of ballots per minute depends on the width or length of the ballot. The following table documents the approximate scanning speed of the ICC scanners.

Scanner	Ballot Size	Pages per Minute (ppm) Scanned
Canon DR-G1130	8.5" x 11"	Approximately 100 ppm, as per Dominion Voting's Quality Assurance test results.
Canon DR-G2140	8.5" x 22"	Aproximately 70 ppm, as per Dominion Voting's Quality Assurance test results.
Canon DR-M160II	8.5" x 11"	Approximately 60 ppm, as per Dominion Voting's Quality Assurance test results.

https://www.sos.state.co.us/pubs/elections/VotingSystems/DVS-DemocracySuite511/documentation/2-03-ICC-FunctionalityDescription-5-11-CO.pdf

REFERENCE C – SCANNERS USED BY MESA COUNTY

DESCRIPTION	QTY	UNIT PRICE	EXTENSION
Central Scanning Hardware & Software License			
ImageCast Central Includes: *Canon DR-G1130 high speed document scanner.* *- ImageCast® Central Software including third party Kofax VRS 4.5 software.* *- OptiPlex 9020 All-in-One Series with pre-loaded software* *- One (1) iButton Programmer and (1) iButton Key Switch & Cat5 RJ 45* *Cables* *- 12 months Hardware Warranty* *- 12 months Firmware License*	4	$18,500	$74,000

https://onbase.mesacounty.us/OnBaseAgendaOnline/Documents/Downloadfile/Special_Meeting_1018_Agenda_Packet_8_24_2021_1_00_00_PM.pdf?documentType=5&meetingId=1018&isAttachment=True

REFERENCE D – DATA MOVEMENT FROM BATCHES TO VOTES

Below please find an example of how the data moves through the system from the batch to its votes, and how the ballot level vote data is obfuscated in the process. Blank and irrelevant fields are omitted.

When batch 4025 was received in the Mesa County November 2020 election, the following record was created in the *batches* table of the Adjudication database.

Field	Value
TabulatorId	10
BatchId	4025
Name	Tabulator 10 - Batch 4025
LoadOrder	60
CreationTime	10/21/20 2:20 PM
ModificationTime	10/22/20 10:33 AM
BallotCount	99
HasAdjudicatedBallots	1

After all adjudication tasks were complete, a record exists in the Main election database *ResultContainer* table.

Field	Value
Id	60
containerType	CVR
resultState	Published
batchId	4025
fileName	1_1_10_4025_DETAIL.DVD
tabulatorId	10
CvrSortOrder	60
TimeStamp	10/19/20 4:12 PM

This table serves as a record of each individual batch received, and the *batchId* field (4025 in this case) references the *BatchId* of the Adjudication database's *Batches* table, as shown above. This is the first evidence of a break in referential integrity, as there is no database-level relationship between these two tables. In

other words, the *Batches* record in the Adjudication database can be removed or altered without any warning or error being generated by the database.

Of note also is that the number of ballots which exists in each batch is not a part of the *ResultContainer* table. This makes reconciling the data in the Main election database tables much more difficult.

From here, the information goes to three other tables of interest in the Main election database. The first is *CastVoteRecord*, which contains the ballot-level vote data.

Id	ResultContainerId	RecordId	PrecinctPortionId	IsCurrent	OriginalCvrId	OutstackConditions	BallotTypeId	tabulatorId	batchId
5892	60	1	124	1	NULL	1088	5	10	4025
5893	60	2	103	1	NULL	1088	7	10	4025
5894	60	3	66	0	NULL	256	8	10	4025
5895	60	4	44	1	NULL	1088	3	10	4025
5896	60	5	111	1	NULL	1088	7	10	4025
5897	60	6	63	1	NULL	1088	7	10	4025
5898	60	7	79	1	NULL	0	7	10	4025
5899	60	8	98	1	NULL	0	7	10	4025
5900	60	9	22	1	NULL	1088	3	10	4025
5901	60	10	22	0	NULL	256	3	10	4025
5902	60	11	111	1	NULL	0	7	10	4025
5903	60	12	134	1	NULL	0	7	10	4025
5904	60	13	134	0	NULL	256	7	10	4025
5905	60	14	4	1	NULL	1088	1	10	4025
5906	60	15	100	1	NULL	1088	7	10	4025
5907	60	16	98	1	NULL	1088	7	10	4025
5908	60	17	40	1	NULL	0	1	10	4025
5909	60	18	129	1	NULL	1088	7	10	4025
5910	60	19	124	1	NULL	1088	5	10	4025
5911	60	20	108	1	NULL	0	7	10	4025
5912	60	21	131	0	NULL	5	7	10	4025
5913	60	22	41	0	NULL	1344	1	10	4025
5914	60	23	42	0	NULL	256	1	10	4025
5915	60	24	13	1	NULL	1088	2	10	4025
5916	60	25	42	1	NULL	1088	1	10	4025
5917	60	26	2	1	NULL	0	1	10	4025
5918	60	27	42	1	NULL	0	1	10	4025
5919	60	28	60	1	NULL	0	7	10	4025
5920	60	29	95	1	NULL	0	7	10	4025
5921	60	30	100	1	NULL	1088	7	10	4025

5922	60	31	10	1	NULL	1088	1	10	4025
5923	60	32	117	1	NULL	1088	5	10	4025
5924	60	33	101	1	NULL	0	7	10	4025
5925	60	34	10	0	NULL	256	1	10	4025
5926	60	35	102	1	NULL	1088	7	10	4025
5927	60	36	60	1	NULL	0	7	10	4025
5928	60	37	101	1	NULL	1088	7	10	4025
5929	60	38	7	1	NULL	1088	1	10	4025
5930	60	39	41	1	NULL	0	1	10	4025
5931	60	40	101	0	NULL	1344	7	10	4025
5932	60	41	62	1	NULL	1088	8	10	4025
5933	60	42	46	1	NULL	1088	1	10	4025
5934	60	43	70	1	NULL	0	8	10	4025
5935	60	44	63	1	NULL	1088	7	10	4025
5936	60	45	100	1	NULL	0	7	10	4025
5937	60	46	94	1	NULL	1088	7	10	4025
5938	60	47	101	1	NULL	1088	7	10	4025
5939	60	48	79	1	NULL	1088	7	10	4025
5940	60	49	131	0	NULL	1	7	10	4025
5941	60	50	3	1	NULL	0	1	10	4025
5942	60	51	108	1	NULL	0	7	10	4025
5943	60	52	63	1	NULL	0	7	10	4025
5944	60	53	105	1	NULL	0	7	10	4025
5945	60	54	100	1	NULL	0	7	10	4025
5946	60	55	17	1	NULL	0	3	10	4025
5947	60	56	40	1	NULL	0	1	10	4025
5948	60	57	101	1	NULL	0	7	10	4025
5949	60	58	60	1	NULL	1088	7	10	4025
5950	60	59	22	0	NULL	1	3	10	4025
5951	60	60	134	1	NULL	1088	7	10	4025
5952	60	61	103	1	NULL	1088	7	10	4025
5953	60	62	60	1	NULL	0	7	10	4025
5954	60	63	7	1	NULL	1088	1	10	4025
5955	60	64	52	1	NULL	0	3	10	4025
5956	60	65	100	1	NULL	1088	7	10	4025
5957	60	66	100	0	NULL	256	7	10	4025
5958	60	67	101	1	NULL	0	7	10	4025
5959	60	68	79	1	NULL	0	7	10	4025
5960	60	69	100	1	NULL	0	7	10	4025
5961	60	70	129	1	NULL	1088	7	10	4025
5962	60	71	98	1	NULL	0	7	10	4025
5963	60	72	138	1	NULL	0	7	10	4025
5964	60	73	119	1	NULL	0	7	10	4025

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5965	60	74	50	1	NULL	1088	1	10	4025
5966	60	75	102	1	NULL	0	7	10	4025
5967	60	76	100	1	NULL	0	7	10	4025
5968	60	77	22	1	NULL	1088	3	10	4025
5969	60	78	60	1	NULL	1088	7	10	4025
5970	60	79	44	0	NULL	1344	3	10	4025
5971	60	80	101	1	NULL	0	7	10	4025
5972	60	81	111	1	NULL	1088	7	10	4025
5973	60	82	129	1	NULL	0	7	10	4025
5974	60	83	98	1	NULL	1088	7	10	4025
5975	60	84	111	1	NULL	1088	7	10	4025
5976	60	85	34	1	NULL	0	1	10	4025
5977	60	86	35	1	NULL	1088	1	10	4025
5978	60	87	17	1	NULL	0	3	10	4025
5979	60	88	50	1	NULL	1088	1	10	4025
5980	60	89	104	1	NULL	0	7	10	4025
5981	60	90	104	1	NULL	0	7	10	4025
5982	60	91	30	1	NULL	0	1	10	4025
5983	60	92	134	1	NULL	0	7	10	4025
5984	60	93	134	1	NULL	1088	7	10	4025
5985	60	94	101	1	NULL	1088	7	10	4025
5986	60	95	105	1	NULL	1088	7	10	4025
5987	60	96	52	1	NULL	1088	3	10	4025
5988	60	97	105	0	NULL	256	7	10	4025
5989	60	98	100	1	NULL	1088	7	10	4025
5990	60	99	98	0	NULL	1344	7	10	4025
9514	60	3	66	1	5894	0	8	10	4025
9515	60	10	22	1	5901	0	3	10	4025
9516	60	13	134	1	5904	0	7	10	4025
9517	60	22	41	1	5913	1088	1	10	4025
9518	60	23	42	1	5914	0	1	10	4025
9519	60	21	131	1	5912	1092	7	10	4025
9620	60	34	10	1	5925	0	1	10	4025
9621	60	49	131	1	5940	1088	7	10	4025
9622	60	40	101	1	5931	1088	7	10	4025
9623	60	59	22	1	5950	1	3	10	4025
9624	60	66	100	1	5957	256	7	10	4025
9625	60	79	44	1	5970	1088	3	10	4025
9626	60	99	98	1	5990	1088	7	10	4025
9728	60	97	105	1	5988	0	7	10	4025

There is one record for each ballot in batch 4025, and then an additional record for each ballot which went through the manual adjudication process. The *IsCurrent* field indicates which of the two ballot records is the latest one. No timestamp exists in this table to be able to determine the time the ballot data was entered or modified.

Unlike a "Cast Vote Record" file, this table contains no vote information.

Next is *ResultSplitter*. Batch 4025 was separated into 42 rows in this table:

Id	numberOfValid	pollingDistrictId	resultContainerId	numberOfWriteIns	tabulatorId	ballotId
2008	1	30	60	0	10	1
2007	2	104	60	0	10	7
2006	1	35	60	0	10	1
2005	1	34	60	0	10	1
2004	2	50	60	0	10	1
2003	1	119	60	0	10	7
2002	1	138	60	0	10	7
2001	2	52	60	0	10	3
2000	2	17	60	0	10	3
1999	3	105	60	0	10	7
1998	1	3	60	0	10	1
1997	1	94	60	0	10	7
1996	1	70	60	0	10	8
1995	1	46	60	0	10	1
1994	1	62	60	0	10	8
1993	2	7	60	0	10	1
1992	2	102	60	0	10	7
1991	8	101	60	0	10	7
1990	1	117	60	0	10	5
1989	2	10	60	0	10	1
1988	1	95	60	0	10	7
1987	5	60	60	0	10	7
1986	1	2	60	0	10	1
1985	1	13	60	0	10	2
1984	3	42	60	0	10	1
1983	2	41	60	0	10	1
1982	2	131	60	0	10	7
1981	2	108	60	0	10	7
1980	3	129	60	0	10	7
1979	2	40	60	0	10	1
1978	9	100	60	0	10	7

1977	1	4	60	0	10	1
1976	5	134	60	0	10	7
1975	4	22	60	1	10	3
1974	5	98	60	0	10	7
1973	3	79	60	0	10	7
1972	3	63	60	0	10	7
1971	4	111	60	0	10	7
1970	2	44	60	0	10	3
1969	1	66	60	0	10	8
1968	2	103	60	0	10	7
1967	2	124	60	0	10	5

The 99 ballots in batch 4025 are segregated here by polling district number. No vote information appears in this table, and this table links back to its corresponding record in the *ResultContainer* table through the *resultContainerId* field. Again, this table contains no specific vote information for the ballots.

Next is the table *ChoiceResult*. Because of how the records are aggregated, there are over 1,600 records for batch 4025. For brevity, only the first 49 records are displayed.

Id	numberOfVotes	isValid	contestResultId	pollingDistrictId	tabulatorId	resultContainerId	choiceId	partyId
72135	2	1	56749	63	10	60	82	0
72136	1	1	56749	63	10	60	83	0
72137	2	1	56750	63	10	60	88	0
72138	1	1	56750	63	10	60	89	0
72139	2	1	56751	79	10	60	2	0
72140	1	1	56751	79	10	60	1	0
72141	2	1	56752	79	10	60	23	5
72142	1	1	56752	79	10	60	22	2
72143	2	1	56753	79	10	60	27	5
72144	1	1	56753	79	10	60	28	2
72145	2	1	56754	79	10	60	32	5
72146	1	1	56754	79	10	60	31	2
72147	2	1	56755	79	10	60	35	5
72148	1	1	56755	79	10	60	36	2
72149	2	1	56756	79	10	60	38	5
72150	2	1	56757	79	10	60	39	5
72151	1	1	56757	79	10	60	40	2
72152	2	1	56758	79	10	60	42	5
72153	1	1	56758	79	10	60	41	2

72154	3	1	56759	79	10	60	44	0
72155	3	1	56760	79	10	60	46	0
72156	3	1	56761	79	10	60	48	0
72157	3	1	56762	79	10	60	50	0
72158	2	1	56763	79	10	60	74	0
72159	1	1	56763	79	10	60	75	0
72160	3	1	56764	79	10	60	76	0
72161	3	1	56765	79	10	60	78	0
72162	3	1	56766	79	10	60	80	0
72163	2	1	56767	79	10	60	53	0
72164	1	1	56767	79	10	60	52	0
72165	3	1	56768	79	10	60	55	0
72166	2	1	56769	79	10	60	56	0
72167	1	1	56769	79	10	60	57	0
72134	3	1	56748	63	10	60	73	0
72133	1	1	56747	63	10	60	71	0
72132	2	1	56747	63	10	60	70	0
72131	3	1	56746	63	10	60	68	0
72130	2	1	56745	63	10	60	66	0
72129	1	1	56745	63	10	60	67	0
72128	2	1	56744	63	10	60	65	0
72127	1	1	56744	63	10	60	64	0
72126	1	1	56743	63	10	60	63	0
72125	2	1	56743	63	10	60	62	0
72124	1	1	56742	63	10	60	60	0
72123	2	1	56742	63	10	60	61	0
72122	2	1	56741	63	10	60	59	0
72121	1	1	56741	63	10	60	58	0
72120	1	1	56740	63	10	60	57	0
72119	2	1	56740	63	10	60	56	0

This table, the only table which actually has a record of the vote totals used to produce reports, aggregates the votes by polling district and candidate or issue choice. As an example, the fifth line of data specifies that there are two votes for Donald Trump (*choiceId* 2, which references the *internalMachineId field* of the table *Choice*) from polling district 3075539035 – GJ (*pollingDistrictId* 79, which references the *internalMachineId* field of the table *PollingDistrict*).

From this table, and the associated tables it links to, all reports are generated. As this is the only table which records vote choices, this is a single point of attack

or failure for the entire vote counting process of the Dominion system. Changes can be made to this table by any process, for instance changing the number of votes or the candidate, would be undetectable as such changes do not affect any other records in any other tables. Nor would such changes require alterations of any other records in any other tables.

Additionally, there is no way to consistently link a particular vote shown in the *ChoiceResult* table to its original ballot within the batch.

The foregoing Forensic Examination and Report was prepared by us, and we are responsible for its content.

The 19th day of March 2022.
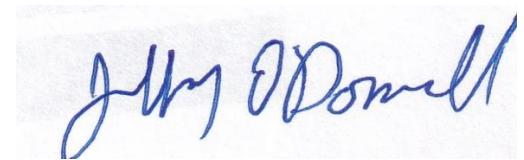
Jeffrey O'Donnell
Chief Information Officer
Ordros Analytics
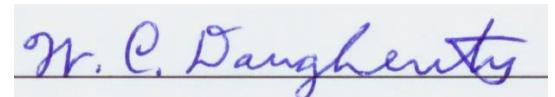
Walter C. Daugherity
Senior Lecturer Emeritus
Department of Computer Science and Engineering
Texas A&M University

BIOGRAPHY

Jeffrey O'Donnell is a Full Stack software and database developer and analyst. He holds Bachelor's degrees in Computer Science and Mathematics from the University of Pittsburgh.

Over the last 40 years, Mr. O'Donnell has worked and consulted for numerous private sector corporations, including Rockwell International, Westinghouse Electric Nuclear, General Defense, U.S. Steel, Mellon Bank, IOTA 360, and the Penn State Applied Research Laboratory. For several years he also delivered and created computer science curriculum for the Community College of Allegheny County.

For the last two decades, Mr. O'Donnell has developed numerous "big data" analysis systems, including systems to provide short-term stock market investors with new types of research and predictive analytics.

He currently is President of Qest Development, a full-service software consulting and publishing company, and is Chief Information Officer of Ordros Analytics, which specializes in election analytics of all types.

Dr. Walter C. Daugherity is a computer consultant and also Senior Lecturer Emeritus in the Department of Computer Science and Engineering at Texas A&M University. He graduated from Oklahoma Christian University with a degree in mathematics, and then earned master's and doctor's degrees from Harvard University, which he attended on a Prize Fellowship from the National Science Foundation.

As a computer expert he has consulted for major national and international firms, and for government agencies. He helped develop the national computer keyboard standard and invented integrated user training within computer applications as well as various electronic computer interfaces.

As a computer science and engineering teacher and researcher, he has published 26 research articles from over $2.8 million in funded research projects, plus conference papers and other publications. He taught many areas of computer science and engineering for 37 years (32 years at Texas A&M University), including artificial intelligence, quantum computing, programming and software design, and cyber-ethics.

At Harvard he received the Bowdoin Prize and medal for writing, and in 2015 was named a Distinguished Alumnus of Oklahoma Christian University. He is a life member of the Association for Computing Machinery and American MENSA.